



# USDA's 1938 Four Mandated ARS Regional Research Centers ERRC, NCAUR (NRRC), SRRC, WRRC

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## Utilization Laboratories

In 1938 the Agricultural Adjustment Act provided:

“The Secretary is hereby authorized and directed to establish, equip, and maintain four regional research laboratories, one in each major farm producing area, and at such laboratories to conduct researches into and **to develop new scientific, chemical and technical uses and new and extended markets** and outlets for farm commodities and products and byproducts thereof....

## Regional Research Center's Overall Mission

To develop and commercialize new uses of agricultural commodities for industrial or nonfood and food products for both domestic markets and export; to improve food safety, quality and security; to develop new technologies to control agricultural pests while minimizing adverse environmental impact; and to provide technical support to Federal regulatory and action agencies.



## ARS Research Locations





## Regional Research Center's Historical Accomplishments

- Fermentation technologies, high yielding penicillium production
- Time-Temperature Tolerance Project helped solve problems - color, texture, flavor, for the fledgling frozen food industry
- Frozen concentrated apple and grape juice - capturing and returning volatile flavors to maintain production quality
- Instant potato flake process
- Supercritical extraction technologies



## Regional Research Center's Historical Accomplishments

*(continued)*

- Durable press cotton textiles
- Flame-retardant cotton finishes
- Glutaraldehyde tanning agents-launderable leather
- Epoxidized ester plasticizers
- Lactose reduction in milk (Lact-aid Dairy Products)
- Fermentation processes for dextran, xanthan gum and levan
- Kenaf paper
- Oatrim





## Regional Research Center's Historical Accomplishments

*(continued)*

- 1970's, identified microbes to ferment biomass and starch to ethanol
- Super slurper
- San Francisco-style sourdough bread
- and 100's more technologies we benefit from as consumers because these basic platform technologies were the basis for new or resurgent multi-million dollar industries, benefiting the farmers, and the American economy



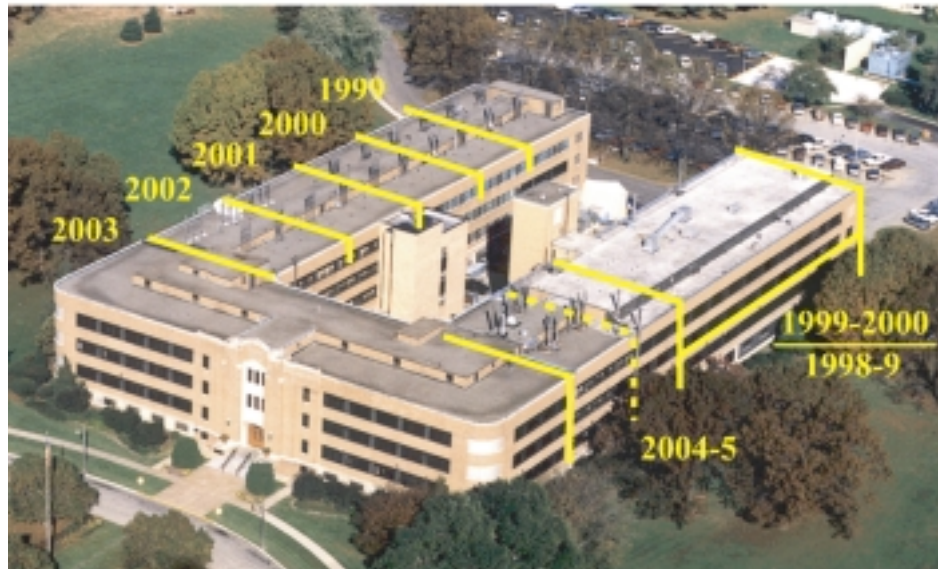
## Selected Focus of Two ARS National Programs

- New uses, quality and marketability of plant and animal products
  - Enhance economic viability and market competitiveness
  - Maintain enhanced quality
  - Environmentally friendly
  - Efficient processing concepts
  - Develop value-added food and nonfood products and processes
- Bioenergy and energy alternatives
  - Reduce dependence on foreign oil
  - Alternative energy sources
  - Improve the environment
  - Increase use of agricultural crops as feedstocks





## Modernization Phases



### *Physical Resources*



- Fully renovated chemistry and biology laboratories
- Industrial & Food Research Pilot Labs



## NATIONAL CENTER FOR AGRICULTURAL UTILIZATION RESEARCH

### Biomaterials Research and Development



- New technology platforms
- Market driven applications
- Fundamental to applied research
- Multidisciplinary teams
- Partnership with private sector
- 120 patents since 1980
- 41% licensed to private sector



## MICROBIAL TECHNOLOGY



- ARS Microbial Collection
- 80,000 strains available
- Discovery of enzyme systems
- Genetic engineered enhancements
- Enzyme stabilization
- Process engineering



## BIO-ENZYME PROCESSING



- Dextran blood extender
- Xanthan gum
  - food ingredient
  - oil well performance enhancer
- Lactic acid
- Xylitol
- Cyclodextrins
- Alternan
- Astaxanthin pigments



## EXTRUSION PROCESSING

Transforming Starch, Fiber and Proteins

- Biodegradable plastics
- Foams and films
- Packaging materials
- Adhesives and glues
- Ion-exchange resins
- Micro-encapsulating







## SOYBEAN OIL PRODUCTS



- Biodiesel fuels
- Fuel additives
- Industrial Lubricants
- Hydraulic fluids
- Oil drilling lubricants
- Litho news inks
- Sheet-fed & heat-set inks
- Paints and Coatings



***Biofuels and Biobased Products Research***

***Western Regional Research Center***

***United States Department of Agriculture  
Agricultural Research Service  
Pacific West Area***

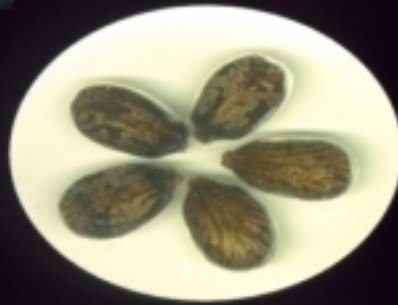
***Albany, CA***







## *Biobased products from new crops*



Toxin-free castor as a source  
of industrial oils



Hypoallergenic rubber  
products from *Guayule*

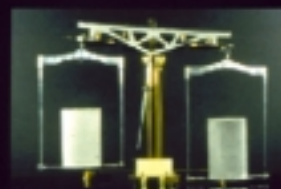


## *Conversion technology: Biobased Products from wheat starch and gluten*

Consumer products  
from foamable starch



Wheat gluten and feather  
resins



Lightweight  
concrete utilizing  
starch gels

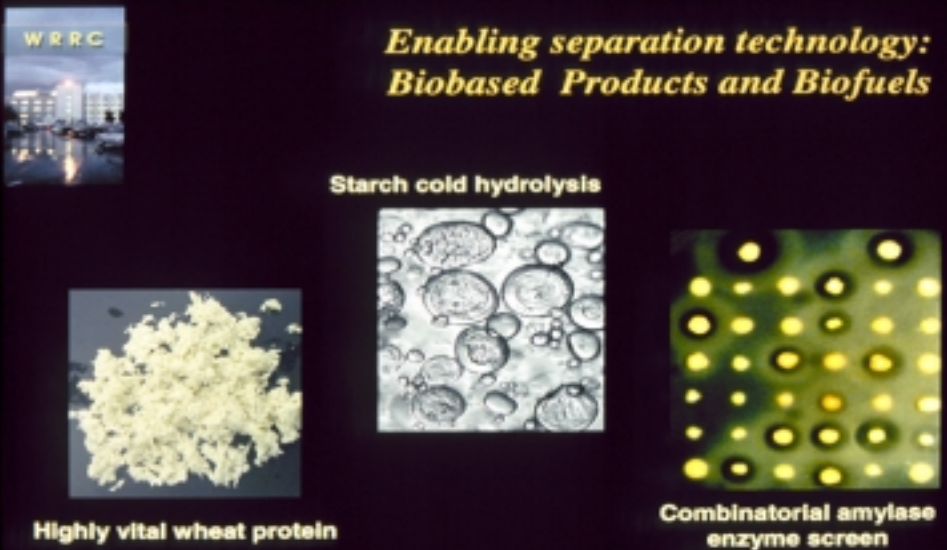
**W R R C**

***Enabling separation technology:  
Biobased Products and Biofuels***

**Starch cold hydrolysis**

**Highly vital wheat protein**

**Combinatorial amylase  
enzyme screen**



## SRRC Program Emphasis





- Cotton Textile chemistry, engineering, fiber quality and bioscience
- Food processing, sensory quality, safety and utilization
- Sugarcane enhancement and quality
- Formosan subterranean termite control



## SRRC - Examples of Biobased Research Results

- Non-food uses of sucrose - new liquid epoxies that bind wood, metal, glass, concrete, etc.
  - Base coats, primers and adhesives for composite materials like particle boarding or boat hulls
- By-products of nut shellers, grain millers, oilseed crushers, sugar refiners - convert to value-added absorbents for water treatment - drinking water and industrial wastewater
- Vegetable soybean oil - chemical and enzymatic conversion of unconjugated linoleic, linolenic acids to conjugated unsaturated fatty acids (CUFA) to form “drying oils” such as Tung oil for industrial use



## ERRC Biobased Processing and Products

New, low cost “green” materials to prepare pectins and hemicelluloses from citrus and sugarbeet by-products, paint additives, coatings, adhesives





## ERRC Biofuels Research

- Process efficiency
  - Continuous fermentation by CO<sub>2</sub> stripping
  - Continuous fermentation - pervaporation
  - Low cost separation of corn zein
- Biodiesel from alternative feedstocks
- Monitoring biodiesel quality - ASTM; alternative methods, HPLC



## ERRC Ethanol Co-Products

- Corn fiber oil
- Lipase and arginine from ethanol steepwater
- Corn fiber gum
- Corn fiber hemicellulose
- Zein wax-coated paper







## Interagency Cooperative Studies

USDA, ARS, ERRC and DOE, NREL

- Modeling corn to ethanol and stover to ethanol processes
- Economic factors associated with starch and cellulosic material processes
- Identify fine chemicals, phytosterols, to tocopherol, in stover and stover residues from ethanol processes
- Estimate value and production costs of co-products



## Tools for Enhanced Transfer Technology

(1986 Technology Transfer Act - President Reagan)

- Cooperative Research and Development Agreement (CRADA)
- Confidentiality Agreements
- Memorandum of Understanding
- Specific Cooperative Agreements
- Trust Fund Projects

In a typical year, 400 technical/scientific papers are published, 78 patent applications are filled and an additional 36 invention disclosures are prepared by researchers at the four Regional Research Centers.



